

## Description

# **Anti-Splash, Anti-Spill Apparatus and Method for Holding Antiseptic Solution During a Surgical Procedure**

### BACKGROUND OF INVENTION

[0001] This invention relates generally to open-top devices such as glasses, bowls and cups used to hold a fluid, and specifically to an apparatus and method for holding antiseptic solution for use during a surgical procedure without splashing or spilling.

[0002] During a surgical procedure, it is often desirable to have available an antiseptic solution for cleaning a patient wound and / or the patient surgical site. This is typically done by introducing (e.g., dipping) a fluid-absorbing surgical equipment item such as a surgical sponge or swab (such as a so-called "two-by-two") or a similar item of surgical equipment into the antiseptic solution and then swabbing at and / or cleaning the wound. Secondly, this antiseptic solution is also used to clean blood and other bodily fluids from other surgical equipment such as scalpels, forceps, clamps, scissors, hemostats, needle holders, biopsy punches and the like by introducing, e.g., dipping the soiled regions of a surgical equipment item into an antiseptic solution such as

sterile water, betadine, or sterile saline solution.

[0003] The amount of such antiseptic solution typically employed during a surgical procedure is not particularly large. Generally, a volume of between approximately 25 and 50 cubic centimeters of such antiseptic solution will suffice. Surgical kits, which are sterilized and wrapped in a sterile package before use, often comprise not only the aforementioned surgical equipment such as fluid-absorbing sponges and swabs, scalpels, forceps, clamps, scissors, hemostats, needle holders, biopsy punches, etc., but also a conventional "shot glass" ordinarily used for the consumption of alcoholic beverages which is pre-sterilized along with all the other instruments. The surgical kit is opened, and this shot glass is set upon a surgical support surface such as a conventional surgical tray and substantially filled with the antiseptic solution. Surgical sponge or swab. Fluid-absorbing surgical equipment is then dipped into the antiseptic solution so as to absorb some of the antiseptic solution, and then this is used to swab or clean the surgical site or wound. Secondly, soiled surgical equipment to be cleaned is introduced into the antiseptic solution as needed to dissolve and thereby clean the blood or other bodily fluids from the soiled surgical equipment.

[0004] A conventional shot glass such as is used for holding antiseptic solution during the surgical procedure generally widens as one moves upward from its base to its top. Additionally, the height of such a conventional shot glass typically is larger than its diameter. This is acceptable and even desirable when the shot glass is used for drinking because when

one is drinking particularly from a very small glass such as a shot glass it is physically much easier and less clumsy to drink if the glass widens from bottom to top, or at least does not narrow from bottom to top. But for the aforementioned use in surgery, a directly contrary set of considerations apply.

[0005] Surgical trays are themselves notoriously unsteady and wobbly.

Resting a conventional shot glass with a height that exceeds its width and with a diameter that grows larger from base to top upon such an surgical tray creates a highly unstable situation, and it is common for such a shot glass filled with antiseptic solution to splash or spill from ordinary jostling of the surgical tray. A much more stable circumstance would be brought about by employing a fluid-holding apparatus with a volume comparable to that of a shot glass, but with a height which does not exceed its width, and with a diameter which is *smaller* at its top than at its base. A fluid-holding apparatus with these general characteristics is much better suited to resting in a stable manner atop a surgical tray without spilling than is a conventional shot glass.

[0006] The prior art shows a number of containers to prevent the container contents from splashing and splashing, and to deflect, dampen, or regulate to movement of fluid within the container. But none is suitable for holding antiseptic solution for use during a surgical procedure without splashing or spilling.

[0007] It is common, for example, to use a removable lip or shield or collar in connection with a paint can or similar relatively voluminous container to

prevent splashing or spilling, as shown, for example, in US patents 3,309,000; 3,356,266; 4,316,560; 4,369,890.

[0008] In addition to the foregoing, US Patent 3,781,164 discloses an anti-spill container for candles, in which a flange (25) curves inwardly and downwardly at a full 180 degree angle to "define a recess which is in the form of a continuous annular channel" (27) (column 42, lines 44-47). This recess contains the melted wax in the event the receptacle is tipped over.

[0009] US 5,593,891 discloses a culture plate with a removable "splash guard for directing liquid flows away from a top edge of a base sidewall and back into the base" (abstract). The splash guard angles inwardly and downwardly at an angle of about 90 to 120 to 135 degrees (see Figures 10, 12, 13 17-19) relative to the upwardly oriented sidewall (8) of the culture plate.

[0010] US 6,386,138 discloses a coloring container in which a funnel (34) curves inwardly and downwardly at a full 180 degree angle. Similarly to US 3,781,164, this serves to contain the liquid being contained if the container is in either the upside down position of Figure 4 or the sideways position of Figure 5 (column 3, lines 47-53).

[0011] US 6,032,824 discloses a spill-less wave bowl for use by pets and small children. Particularly, it is "designed to be used by pet owners for a pet's water, milk, etc. and used by small children when eating cereal and other food items to reduce and prevent spillage" (column 1, lines

38-42). This bowl comprises "sloping sides extending upwardly and inwardly, [and] an inwardly curved inverted concave-shaped lip which forms an interior concave-shaped cavity inside an upper portion of the shell" (abstract). Essential to this device is "an inwardly curved *inverted* concave-shaped lip" (independent claims 1 and 8, emphasis added). This device utilizes two distinct components, namely an outer shell (12) comprising the "an inwardly curved inverted concave-shaped lip," and a separate inner bowl (14). (See column 2, lines 48-60.)

[0012]

It is worthy of note that each and every one of these references teach that the component most directly preventing splashing (e.g., lip, guard, funnel), is always required to be *greater than or equal to 90 degrees relative to the container side walls*. None of these references, with the sole exception of US 6,032,824, discloses or suggests a base wider than the top opening. All of these references contain a volume substantially in excess of the shot glass-sized 25 to 50 cubic centimeters typically employed for holding antiseptic solution. Physically, when one is employing a fluid-holding apparatus with a volume on the order of 25 to 50 cubic centimeters, the linear dimensions are smaller, which means that the fluid disturbance from a given perturbation will be less pronounced than it is in a larger container, and the surface tension holding the fluid surface intact is increased because of the small exposed fluidic surface area. Because of this smaller disturbance in improved surface tension for a smaller-volume container, and oppositely to what the above-cited references

teach, the smaller fluid volume can be effectively contained without splashing by a lip inwardly angled at less than 90 degrees relative to the container side walls. In fact, this angle can be below 75, 60 or 45 degrees down to as little as 15 degrees, and preferably about 30 degrees. This is not the case with the larger-volume containers cited above. Finally, none of these references disclose, suggest or motivate their use as part of a surgical kit for holding antiseptic solution for use during a surgical procedure, and due to their volumes, sizes, and purposes, none of these references would be properly suited for such a use. The only properly-sized container in the prior art a shot glass has other characteristics as discussed above which make it prone to the splashes and spills which are to be avoided by the invention disclosed herein.

[0013] Thus, it is desired to provide a shot glass-sized fluid-holding apparatus for holding antiseptic solution for use during a surgical procedure without splashing or spilling, which avoid the problems that occur when actual shot glasses are used for this purpose as is now the present surgical practice.

## SUMMARY OF INVENTION

[0014]

An anti-splash, anti-spill fluid-holding apparatus is disclosed herein, comprising: an inner side surface comprising an inner mid section diameter thereof continuing inwardly to an inner upper section diameter thereof which is smaller than the inner mid section diameter; an outer side surface comprising an outer mid section diameter thereof

continuing to an outer lower section diameter thereof which is larger than the outer mid section diameter; an inward angle comprising a less than 90 degree angle tangential to any point along the inner side surface from the inner mid section diameter to the inner upper section diameter; an open top circumscribed by the inner upper section diameter; and a base circumscribed by the outer lower section diameter.

[0015]

The related method disclosed herein for preventing spilling and splashing of an antiseptic solution during a surgical procedure, comprises the steps of: setting a fluid-holding apparatus upon a surgical support surface; substantially filling the fluid-holding apparatus with the antiseptic solution; preventing the splashing of the antiseptic solution using a inner side surface of the fluid-holding apparatus comprising an inner mid section diameter thereof and continuing inwardly to an inner upper section diameter thereof which is smaller than the inner mid section diameter; preventing the spilling of the antiseptic solution using an outer side surface of the fluid-holding apparatus comprising an outer mid section diameter thereof and continuing outwardly to an outer lower section diameter thereof which is larger than the outer mid section diameter and using a base circumscribed by the outer lower section diameter; introducing a fluid-absorbing surgical equipment item into the antiseptic solution to absorb some of the antiseptic solution; and cleaning a patent wound or surgical site by applying the fluid-absorbing surgical equipment with the

antiseptic solution absorbed therein proximate the patent wound or surgical site.

## BRIEF DESCRIPTION OF DRAWINGS

[0016] The features of the invention believed to be novel are set forth in the appended claims. The invention, however, together with further objects and advantages thereof, may best be understood by reference to the following description taken in conjunction with the accompanying drawing(s) as summarized below.

[0017] Figure 1 comprises a top plan view projected to a side cross-sectional view along the cross-section line 1â, of a preferred embodiment of a fluid-holding apparatus in accordance with the invention.

[0018] Figure 2 is a perspective view of the preferred embodiment of Figure 1.

[0019] Figure 3 schematically illustrates sterilizing the preferred and any other embodiments of the invention to a degree suitable for utilization in surgical procedures.

[0020] Figure 4 schematically illustrates the preferred embodiment of Figures 1 and 2 in combination with a surgical kit.

[0021] Figure 5 is a perspective view illustrating the method step of setting the fluid-holding apparatus upon a surgical support surface.

[0022] Figure 6 is a perspective view illustrating the method step of substantially filling the fluid-holding apparatus with an antiseptic solution.

[0023] Figure 7 is a perspective view illustrating the method step of cleaning surgical equipment by introducing a fluid-absorbing surgical equipment item into the antiseptic solution in the fluid-holding apparatus so that this can be applied to clean patent wound or surgical site.

## DETAILED DESCRIPTION

[0024] Figure 1 illustrates an anti-splash, anti-spill fluid-holding apparatus 1 in preferred embodiment of the invention. Below is a top plan view. Above is a side cross-sectional view along line 1â1, projected to the top plan view. Figure 2 illustrates anti-splash, anti-spill fluid-holding apparatus 1 in perspective view.

[0025] The anti-splash, anti-spill fluid-holding apparatus 1 illustrated in Figure 1 comprises an inner side surface 101 comprising an inner mid section diameter 102 thereof. Inner side surface 101 continues inwardly to an inner upper section diameter 103 thereof which is smaller than inner mid section diameter 102. An outer side surface 104 comprises an outer mid section diameter 105 thereof. Outer side surface 104 continues to an outer lower section diameter 106 thereof which is larger than mid section diameter 105. Toward the upper section of inner side surface 101, fluid-holding apparatus 1 comprises an inward angle 107 comprising a less than 90 degree angle tangential to any point along inner side surface 101 from inner mid section diameter 102 to inner upper section diameter 103. That is, along the entire region of inner side surface 101 running upwardly from inner mid section diameter 102 to inner upper section diameter 103, a inward tangent line 110, drawn

tangentially to any point of inner side surface *101* as shown, always makes an inward angle *107* of less than 90 degrees. In this the preferred embodiment, inward angle *107* comprises a no more than approximately 30 degree angle tangential to any point from inner mid section diameter *102* to inner upper section diameter *103*. Finally, fluid-holding apparatus *1* comprises an open top *108* circumscribed by inner upper section diameter *13*, and a base *109* circumscribed by outer lower section diameter *106*.

[0026] In an alternative preferred embodiment, inward angle *107* comprises a no more than approximately 60 degree angle tangential to any point along inner side surface *101* from inner mid section diameter *102* to inner upper section diameter *103*. In yet another alternative preferred embodiment, inward angle *107* comprises a no more than approximately 45 degree angle tangential to any point along inner side surface *101* from inner mid section diameter *102* to inner upper section diameter *103*. In yet another alternative preferred embodiment, inward angle *107* comprises a no more than approximately 15 degree angle tangential to any point along inner side surface *101* from inner mid section diameter *102* to inner upper section diameter *103*.

[0027] This inward angle *107* of less than 90 degrees tangentially to any point of inner side surface *101* is to be contrasted with the need for a corresponding angle of a full 180 degrees in US 3,781,164, US 6,032,824, and US 6,386,138, and to the angles of 90 or greater degrees in US 5,593,891. The invention disclosed herein omits any

anti-splash element comprising an inward angle *107* greater than or equal to 90 degrees tangentially at any point between inner mid section diameter *102* and inner upper section diameter *103* which was found to be necessary in all of US 3,781,164, US 5,593,891, US 6,032,824, and US 6,386,138, because this invention renders such an angle unnecessary.

[0028] Note that there would be no motivation and indeed contrary motivation to design a regular drinking glass with a narrower top diameter as shown in Figures 1 and 2 because this would impede drinking by making it difficult for the drinker's lips to make adequate contact with the rim of the glass without spilling. Indeed, it would be *especially* difficult to drink from a shot-sized glass with these characteristics, because as noted, a 25 to 50 cubic centimeter glass would have a relatively small diameter in the range of 3 to 6 centimeters. Especially if this diameter were to narrow toward its top, such a 25 to 50 cubic centimeter glass, given its tight radius of curvature, would be quite awkward to effectively drink from, because the drinker's lips could not make proper contact with the top rim and in all likelihood the beverage being consumed would be prone to spill, and the drinker's nose would butt up against the region of the top rim opposite the drinker's lips and require use drinker to tilt his or her face significantly upward in order to the point of discomfort in order to compete successful drinking.

[0029] In short, a conventional shot glass is well suited for drinking but poorly suited for holding antiseptic solution for use during a surgical

procedure. In contrast, the anti-splash, anti-spill fluid-holding apparatus is well suited for holding antiseptic solution for use during a surgical procedure but poorly suited for drinking. Neither one motivates the other for its intended purpose, and indeed, they each teach away from one another for their respective intended purposes.

[0030] It is to be observed that inward angle *107* continuously increases at all points along inner side surface *101* from inner mid section diameter to inner upper section diameter *103*. This is in contrast to the sharp, substantially *discontinuous* angles of US 3,781,164 and US 6,386,138 which jump sharply and substantially discontinuously from 0 to 90 degrees and then from 90 to 180 degrees, and of US 5,593,891 which jumps sharply and substantially discontinuously from 0 to 90, 120 or 135 degrees depending on the embodiment in question.

[0031] It is also suitable to characterize inward angle *107* indirectly, in terms of the ratio achieved between inner mid section diameter *102* and the smaller inner upper section diameter *103*. Preferably, fluid-holding apparatus *1* comprises an inner section ratio of approximately 1 to .875 (1.14) between inner mid section diameter *102* and inner upper section diameter *103*, which is approximately what is illustrated. Alternatively, however, this ratio may be as large as approximately 1 to .75 (1.33) in which case there is a fairly sharp difference in diameter reduction moving from inner mid section diameter *102* to inner upper section diameter *103*, or as small as approximately 1 to .9375 (1.07) in which case there is a milder diameter reduction.

[0032] It is also noted that in the embodiment illustrated, all of these elements inner side surface *101*, outer side surface *104*, the points along inner side surface *101* forming inward angle *107*, and base *109* comprise a single, unitary article of fabrication. This is in contrast particularly to US 6,032,824 which comprises an outer shell (12) separate from inner (14), US 6,386,138 in which the cup (20) is separate from the lid (30), as well as most of the embodiments of US 5,593,891.

[0033] As discussed earlier, the fluid-holding volume *111* (see Figure 2) in the interior region of fluid-holding apparatus *1* is no less than approximately 25 cubic centimeters and no greater than approximately 50 cubic centimeters. A preferred volume is approximately 37.5 cubic centimeters. This volume is substantially smaller than what is used for an ordinary drinking glass or food bowl, and is substantially smaller than what is disclosed or suggested or motivated by any of the prior art cited earlier. As noted above, due to the smaller fluid-holding volume *111* and the consequently smaller linear dimensions of fluid-holding apparatus *1*, fluid disturbance from a given perturbation are be less pronounced. In addition, the smaller exposed fluidic surface area yields a higher surface tension. This allows effective splash containment an inward angle *107* of less than 90 degrees, and as small as 75, 60, 45, 30, or even 15 degrees maximum at any inward tangent line *110*.

[0034] Regarding linear dimensions, inner side surface *101* comprises an inner side surface height *112* no greater than inner mid section diameter *102*. Preferably, inner side surface *101* comprises an inner

side surface height 112 no greater than approximately 4 centimeters and no less than approximately 2 centimeters, and an inner mid section diameter 102 no greater than approximately 6 centimeters and no less than approximately 3 centimeters. Ideally, inner side surface 101 comprises an inner side surface height 112 of approximately 3 centimeters and an inner mid section diameter 102 of approximately 4 centimeters. Assuming that the top view is substantially circular which is highly preferred but not required, the radius will be equal to inner mid section diameter 102 divided by 2, and for such a 3x4 cm configuration, the volume will be thus be  $3\pi \left(\frac{d}{2}\right)^2 h = 37.68$  cubic centimeters, which is approximately at the midpoint between the preferred 25 and 50 cubic centimeter fluid-holding volume 111 discussed earlier. Again, because of the smaller fluid-holding volume 111 and the consequent smaller linear dimensions of fluid-holding apparatus 1 compared to conventional glasses and bowls and compared to the prior art of the reduced turbulence allows one to utilize a smaller inward angle 107. The reduced exposed fluidic surface area also allows one to utilize a smaller inward angle 107. Thus, smaller fluid-holding volume 111 brings about a reduction in physical turbulence and the smaller exposed fluidic surface area brings about an increase in surface tension which in turn allows for a smaller inward angle 107, and this is novel and nonobvious result that goes beyond merely scaling down the linear dimensions such as inner mid section diameter 102 and inner side surface height 112 from the fluidic containers customarily employed in the art.

[0035] As discussed earlier, fluid-holding apparatus 1 also comprises an outer side surface 104 comprising an outer mid section diameter 105. Outer side surface 104 continues to an outer lower section diameter 106 which is larger than outer mid section diameter 105. Base 109 is circumscribed by this outer lower section diameter 106. A wider base 109 ensures stability against tipping and spilling, whereas conventional shot glasses which actually become narrower toward their base and quite prone to tipping and spilling. In a preferred embodiment, toward the lower end of outer side surface 104, fluid-holding apparatus 1 comprises an outward angle 113 comprising an approximately 30 degree angle tangential to at least one point from outer mid section diameter 105 to outer lower section diameter 106, in the manner illustrated by tangent line 114.

[0036] In alternative preferred embodiments, or within a single embodiment, the inward tangent 114 to at least one point from the outer mid section diameter 105 to the outer lower section diameter 106 may be approximately 90, 75, 60, 45 or 15 degrees.

[0037] Similarly to what was done earlier for inward angle 107, it is also suitable to characterize outward angle 113 indirectly, in terms of the ratio achieved between outer mid section diameter 105 and outer lower section diameter 106. Preferably, fluid-holding apparatus 1 comprises an outer section ratio of approximately 1 to 1.33 (.75) between outer mid section diameter 105 and outer lower section diameter 106. However, it is also suitable to employ an outer section ratio of no less

than 1 to 1.5 (.67) which is indicative of a substantially-wider base, and no more than 1 to 1.1 (.91) which is indicative of a mildly-wider base.

[0038] As discussed in the background of the invention, surgical kits often comprise not only the surgical equipment such as fluid-absorbing sponges and swabs, scalpels, forceps, clamps, scissors, hemostats, needle holders, biopsy punches, etc., but they also comprise also a conventional "shot glass" ordinarily used for the consumption of alcoholic beverages, sterilized and then wrapped into the same sterile package with the remaining surgical equipment. This, as illustrated in Figure 3, fluid-holding apparatus 1, before use, is in a sterile state suitable for utilization in surgical procedures using any sterilizing means 3 therefor known or which may become known to those of ordinary skill, such as but not limited to sterilization using various sterilizing fluids and chemicals, and / or heat and / or steam.

[0039] Then, as illustrated in Figure 4, fluid-holding apparatus 1 is combined into a surgical kit 4, with surgical kit 4 comprising fluid-holding apparatus 1 and at least one item of surgical equipment 41, as illustrated in Figure 4. Note that surgical equipment 41 includes illustration of a fluid-absorbing sponge or swab in this case the two-by-two shown toward the right side of surgical kit 4 in Figure 4.

[0040] We now turn to discuss the method for using fluid-holding apparatus 1 for preventing spilling and splashing of an antiseptic solution during a surgical procedure. Figure 5 illustrates the step of setting fluid-holding apparatus 1 upon a surgical support surface 5 such as but not limited to

a surgical tray. Note that at least one item of surgical equipment 41 is also set upon surgical support surface 5. Figure 6 illustrates the step of substantially filling fluid-holding apparatus 1 with the antiseptic solution 6. The order of carrying out these two steps does not matter; that is, fluid-holding apparatus 1 may be placed upon surgical support surface 5 and then filled with antiseptic solution 6, or fluid-holding apparatus 1 may be filled with antiseptic solution 6 and then placed upon surgical support surface 5. As discussed earlier in connection with Figure 1, fluid-holding apparatus 1 prevents splashing of antiseptic solution 6 using an inner side surface 101 comprising an inner mid section diameter 102 and continuing inwardly to an inner upper section diameter 103 which is smaller than the inner mid section diameter 102. Additionally, fluid-holding apparatus 1 prevents spilling of antiseptic solution 6 using an outer side surface 104 comprising an outer mid section diameter 105 and continuing outwardly to an outer lower section diameter 106 which is larger than outer mid section diameter 105 and using a base 109 circumscribed by outer lower section diameter 106. Figure 7 illustrates the final step of introducing a fluid-absorbing surgical equipment item 41 into antiseptic solution 6 in fluid-holding apparatus 1 through an open top 108 of fluid-holding apparatus 1 circumscribed by inner upper section diameter 103, to absorb some of antiseptic solution 6, such that that a patent wound or surgical site may thereafter be cleaned by applying the fluid-absorbing surgical equipment 41 with antiseptic solution 6 absorbed therein proximate the patent wound or surgical site.

[0041] As noted, secondarily, antiseptic solution 6 is also used for cleaning other surgical equipment 41 such as scalpels, forceps, clamps, scissors, hemostats, needle holders, biopsy punches by introducing a soiled region of the surgical equipment 41 into antiseptic solution 6 in fluid-holding apparatus 1 through open top 108, in a manner similar to that illustrated in Figure 7 for the fluid-absorbing surgical equipment 41.

[0042] In a preferred embodiment, splashing is prevented by continuing inner side surface 101 inwardly from inner mid section diameter 102 to inner upper section diameter 103 using an inward angle 107 comprising a less than 90 degree angle tangential (110) to any point along inner side surface 101 from inner mid section diameter 102 to inner upper section diameter 103. However, one could also employ for fluid-holding apparatus 1, a shot-glass-volume device with an inward angle 107 greater than or equal 90 degrees because among other reasons all of the aforementioned prior art which utilizes an inward angle 107 greater than or equal 90 degrees does not disclose, suggest or motivate in any way, separately or in combination, the novel and nonobvious method of using of such devices for preventing spilling and splashing of an antiseptic solution during a surgical procedure as set forth above.

[0043] All of the many structural variations, embodiments and combinations for fluid-holding apparatus 1 earlier discussed in connection with Figures 1 through 4 apply equally in connection with preventing splashing and spilling in connection with the method illustrated in Figures 5 through 7.

[0044] While only certain preferred features of the invention have been

illustrated and described, many modifications and changes will occur to those skilled in the art. It is, therefore, to be understood that the appended claims are intended to cover all such modifications and changes as fall within the true spirit of the invention.